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fourteen miles to Mount Morris, where it emerges into an alluvial valley from one to two miles wide.

Geologists have calculated that the Devonian rocks exposed in the Portage gorge were formed over 37,000,000 years ago. But the Glen Iris gorge is not a part of the ancient Genesee valley. It was cut through the thick mantle of glacial débris that accumulated in the Ice Age. Mr. Hall gives a popular account of what geologists have revealed of the life history of this wonderful gorge. Among the fossils is a superb mastodon head, now in the Letchworth Park Museum.

CLIMATE AND MAN.*

BY

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Man's climatic environment affects him in many ways. His clothing, dwellings, food, occupations, and customs; his physical and mental characteristics; his systems of government; his migrations; his history—all are affected to a greater or less degree.

Civilized man protects himself more or less successfully against unfavourable climatic features. Thus, there is a gradual transition from the primitive shelter made of branches of trees, of skins, or leaves, to the permanent and highly elaborate modern building, which is both heated and cooled artificially. The building materials; the methods of uniting these materials, by braiding, or binding, or by the use of mortar, usually show the control of climate. Moreover, the material often determines the general plan of the building. There is also the transition from the primitive and scanty clothing made of leaves or bark where trees grow, or the skin of an animal where trees are lacking or warmer clothing is needed, to the manufactured and perhaps imported garment of wool, or cotton, or silk. Again, there is the increasing variety of food, from that of primitive man, supplied directly where he lives, to the highly-varied diet found in a civilized community to-day, to which distant latitudes are made to contribute their local delicacies.

All these changes man has brought about. But he cannot change his climate. Slight local modifications may be secured here and there, as by planting trees to serve as wind-breaks, or perhaps by increasing the relative humidity a little through the construction of an artificial reservoir. No such modification is possible in man's climatic environment as has been accomplished on the surface of the land under human agency. The atmosphere is as essentially un-alterable as it is all-pervading. When we see how plants and animals are affected by atmospheric conditions, it is not unreasonable that we should expect man to show effects of a similar kind.

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* From a forthcoming book on *Climate*.

It is, however, easy to go too far in calling upon climate to explain phenomena which we may otherwise find it difficult to account for. This was the mistake formerly made by many writers on this subject, as has been clearly pointed out by Ratzel in his *Anthropogeographie,* where he gives an outline of many of these earlier views. Maupertuis and others held that the colour of man's skin becomes paler with increasing distance from the equator. Livingstone wrote that in Africa religious ideas also seemed to depend on distance from the equator. One writer held that cold produces a small stature; another believed that the Pygmies are small because of the heavy seasonal rains which fall in hot equatorial Africa. Climate was believed to explain the overhanging eyebrows and partly-closed eyes of the negro; the small eyes and beardless faces of the Chinese; the (supposed) fact that more twins were born in Egypt than elsewhere. And so on. The broad generalizations of Montesquieu, Voltaire, Buffon, Hume, Buckle, and others furnish interesting reading, and contain much that is suggestive and instructive, but they usually carry us well beyond the range of reasonable probability. Even Hipprocrates' observations on climatic controls are not without value to-day.

To most of these older writers climate meant more than it does to-day. It included much of what is now termed our whole physical environment. Moreover, they based their conclusions upon incomplete records, covering far too short periods of time. It must be remembered that we are dealing here with large, important, highly complex phenomena. Man moves readily from place to place; from climate to climate. His food, drink, habits, occupations; to some extent his physical and mental characteristics, change in consequence. Inheritance, intermarriage, environment, opportunities, soil, and many other factors enter in to determine what changes individual man and the race as a whole shall undergo. Time is a very important element in the final result, for in time a gradual adaptation to new conditions takes place. Climate is but one of many controls, albeit a most important one, for it largely determines what many of the other factors, such as diet, customs, and occupations, for example, shall be. The task of giving climate its proper place as a factor controlling the life of man as a whole is a difficult one, which cannot be definitely and satisfactorily solved to-day or to-morrow.

It would take us far beyond our limits were we to attempt any consideration of the many complex problems in connection with the possible influences of climate upon the physical and mental characteristics of man. Investigations along these lines have given rise to much debate. It is our present purpose merely to point out some of the more simple and obvious ways in which the life of man is controlled by climate. This control, it should be observed, is either direct, where physical and mental changes under climatic stimulus are concerned, or indirect, as when climate acts upon man through its influence over the distribution of the animals and plants, upon which man depends for his food, clothing, and materials of various kinds.

Climate determines both how and where man shall live. It classifies the earth's surface for us into the so-called habitable and uninhabitable regions. The deserts of sand and the deserts of snow and ice, whether the latter be near sea-level or high up on mountain tops, are alike climatic—the former because of aridity, the latter because of cold. The only non-climatic deserts are recent lava-flows. Where a soil is present which is not frozen for much over half the year, and where there is reasonable temperature and sufficient rainfall, plants and animals are found, ranging from few and lowly forms whre conditions are the hardest and where all organic life is especially adapted to these conditions, to the greatest abundance, where conditions are most favourable.

Man is influenced by much the same controls as those which affect plants and the lower animals. From the highest latitudes he is excluded by cold. The higher altitudes are hostile both because of cold and of diminished pressure. The deserts of sand are uninhabited or thinly populated by reason of aridity. Forests, where rainfall is abundant, are unfavourable to a dense population. The trees must be cleared away before settlement is easy. Man is widely distributed over the earth's surface. In his migrations he has carried with him, beyond their original limits, many plants and animals. Ratzel points out that the coldest place in the world in January is a Siberian city, Verkhoyansk; while one of the hottest places in the world is Massaua, on the Red Sea, the capital of the Italian colony of Eritrea. But the life of man is harder here and easier there, according to climatic conditions and the scarcity or abundance of plant and animal life.

Man is distributed in great belts around the world corresponding roughly to the broad zones of vegetation, desert, steppe, and forest, the limits of which are set by temperature and rainfall, but man is much more dependent on rainfall than upon temperature. Water he must have, directly from the clouds, or indirectly through rivers, or springs, or wells, or from melted snow and ice. There are certain common conditions of life which affect the people who live in the same zone in the same broad, general way, just as these zones have similar general conditions of winds and of rainfall. This, as Ratzel has pointed out, means that there is a climatic factor at work to maintain differences between the people of different zones, in spite of the great movements which are constantly tending to produce uniformity. Obviously the differences in the life of man which depend upon climate will be most noticeable, and will be likely to have the greatest historical significance, when marked differences of climate are found close together, as in the case of mountain ranges like the Alps, or of a pronounced lowland, plateau, and mountain topography like that of Peru or Mexico.

All the regions of sparse population are gradually being encroached upon by an invasion from their borders. Forests are being cleared and replaced by open agricultural lands. Wheat and corn are replacing grass on the steppes and savannas, especially where irrigation can be practised. Deserts are being reclaimed for farming here and there where water is available. The more civilized man becomes, the denser the population which the different parts of the earth can be made to support. From the wandering hunting and fishing tribes of the African forest or of the borders of the Arctic Sea, through the farming populations of the cleared forest and of the steppe, to the crowded industrial centres of the modern city, there is such a gradation. It is the story of a more complete to a less complete mastery of man by his environment. But in spite of all that man can do, the largest climatic limitations persist. The Greenland desert of snow and ice and the Saharan desert of sand must remain practically deserted.